Claims

1. A backprojection unit (37) adapted for backprojecting
pixel data of n acquired projections (53) onto a voxel sub-
volume (58), with n being a natural number, wherein said
backprojection unit (37) comprises for each of the n projec-
tions:
- voxel center determination means adapted for projecting m
   contiguous voxels onto a respective one of the projections,
   with $m \geq 2$ being a natural number, thus obtaining m pro-
   jected voxel centers (62, 63, 64, 65) per projection;
- memory access means adapted for fetching, for each of the m
   projected voxel centers, pixel data of pixels adjacent to
   the projected voxel center from a respective projection
   buffer (50);
- multiplexing means (70) adapted for distributing the
   fetched pixel data to m different pipelines (38, 39, 40,
   41).

2. The backprojection unit according to claim 1, further com-
prising n projection buffers, with each of the projection
buffers being adapted for storing pixel data of one of the n
projections.

3. The backprojection unit according to claim 2, wherein each
of the projection buffers comprises at least (2m+2) different
memory banks.

4. The backprojection unit according to claim 3, wherein the
memory access means are adapted for accessing some of the at
least (2m+2) memory banks of the corresponding projection
buffer in parallel.

5. The backprojection unit according to claim 1 or any one of
the above claims, wherein pixel data of neighboring pixels
are stored in different memory banks.

6. The backprojection unit according to claim 1 or any one of the above claims, wherein a respective memory bank a pixel is stored in is selected by means of a multidimensional index, wherein the multidimensional index is derived from the pixel coordinates (x, y).

7. The backprojection unit according to claim 1 or any one of the above claims, wherein a two-dimensional index (u, v) derived from the pixel coordinates (x, y) is used for selecting a respective one of the memory banks.

8. The backprojection unit according to claim 7, wherein, for m = 4, the two-dimensional index (u, v) is determined as (u, v) = (x mod 5, y mod 2).

9. The backprojection unit according to claim 1 or any one of the above claims, wherein at least one of the pipelines comprises:
- pixel data interpolation means adapted for performing a bilinear interpolation of the pixel data of pixels adjacent to a respective projected voxel center, in order to obtain an interpolated pixel value at the respective projected voxel center.

10. The backprojection unit according to claim 9, wherein at least one of the pipelines further comprises:
- a weighting unit adapted for weighting the interpolated pixel value at the projected voxel center with the inverse square of the distance between voxel and source, in order to obtain a weighted pixel value at the projected voxel center.

11. The backprojection unit according to claim 10, wherein at least one of the pipelines further comprises:

- an adder unit adapted for adding the weighted pixel value
  at the projected voxel center to voxel data of the corre-
  sponding one of the m contiguous voxels.

12. The backprojection unit according to claim 11, wherein
the weighted pixel values are added to the contents of stor-
age cells that belong to m different shift registers.

13. The backprojection unit according to claim 1 or any one
of the above claims, wherein voxel data of the m contiguous
voxels is stored in storage cells of m shift registers, said
shift registers being adapted for accumulating the contribu-
tions of the n projections.

14. The backprojection unit according to claim 12 or claim
13, wherein each of the m shift registers comprises n storage
cells that correspond to the n different projections.

15. The backprojection unit according to claim 12 or any one
of the above claims, wherein, after voxel data stored in the
m shift registers has been updated, the contents of the shift
registers are shifted by one position in order to consecu-
tively process the contributions of the n different projec-
tions.

16. The backprojection unit according to claim 1 or any one
of the above claims, wherein the voxel subvolume is a slice
of a voxel volume.

17. The backprojection unit according to claim 16, wherein
the slices are oriented perpendicular to an axis of rotation
that has been used for acquiring the projections.

18. The backprojection unit according to claim 1 or any one
of the above claims, wherein a voxel volume is initially seg-
mented into a plurality of columns, with each voxel subvolume
being a slice of a respective column.

19. The backprojection unit according to claim 1 or any one
of the above claims, wherein the backprojection unit is im-
plemented as a hardware unit, in particular by means of a
5   Field Programmable Gate Array (FPGA).

20. A method for backprojecting pixel data of n acquired pro-
jections (53) onto a voxel subvolume (58), with n being a
natural number, the method comprising the following steps
10   that are carried out for each of the n projections:
     - projecting m contiguous voxels onto a respective one of the
       projections, with m ≥ 2 being a natural number, thus ob-
       taining m projected voxel centers (62, 63, 64, 65) per pro-
       jection;
15   - fetching, for each of the m projected voxel centers, pixel
       data of pixels adjacent to the projected voxel center from
       a respective projection buffer (50), and
     - distributing the fetched pixel data to m different pipe-
       lines (38, 39, 40, 41).
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21. The method according to claim 20, wherein the pixel data
of the n projections are stored in n separate projection
buffers.

25   22. The method of claim 20 or claim 21, wherein the step of
fetching comprises accessing at least some of the at least
(2m+2) memory banks in parallel.

23. The method of any of claims 20 to 22, further comprising
30   a step of selecting a respective memory bank by means of a
multidimensional index that is derived from the pixel coordi-
nates (x, y).

24. The method of any of claims 20 to 23, further comprising
35   a step of selecting a respective memory bank by means of a
two-dimensional index (u, v) that is derived from the pixel
coordinates (x, y).

25. The method of any of claims 20 to 24, further comprising
a step of performing a bilinear interpolation of the pixel
data of pixels adjacent to a respective projected voxel cen-
ter, in order to obtain an interpolated pixel value at the
respective projected voxel center.

26. The method of claim 25, further comprising a step of
weighting the interpolated pixel value at the projected voxel
center with the inverse square of the distance between voxel
and source, in order to obtain a weighted pixel value at the
projected voxel center.

27. The method of claim 26, further comprising a step of add-
ing the weighted pixel value at the projected voxel center to
voxel data of the corresponding one of the m contiguous vox-
els.

28. The method of any of claims 20 to 27, further comprising
a step of accumulating the contributions of the n projections
by means of m shift registers, whereby each of the m shift
registers comprises n storage cells that correspond to the n
different projections.

29. The method of claim 28, further comprising a step of
shifting the contents of the m shift registers by one posi-
tion, after voxel data stored in the m shift registers has
been updated, in order to consecutively process the contribu-
tions of the n different projections.

30. The method of any of claims 20 to 29, Wherein slices of a
voxel volume are chosen as voxel subvolumes, with the slices
being oriented perpendicular to an axis of rotation that has
been used for acquiring the projections.

31. The method of any of claims 20 to 30, further comprising
a step of initially segmenting a voxel volume into a plural-

ity of columns, with slices of said columns being chosen as voxel subvolumes.

32. The method of claim 31, wherein a separate backprojection
5   is performed for each slice of the column.

33. Computer program product, comprising computer program me-
ans adapted to embody the features of the backprojection unit
as defined in anyone of claims 1 to 18 when said computer
10 program product is executed on a computer, digital signal
processor, or the like.

34. Computer program product, comprising computer program
means adapted to perform the method steps as defined in any-
15 one of claims 20 to 32 when said computer program product is
executed on a computer, digital signal processor, or the
like.

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